WIND STATION

TOPIC:

Wind Speed and Direction

INTRODUCTION:

The heating effect of the Sun causes air to move. It rises over the hotter parts of the world and flows toward the colder parts, where it sinks and flows back to the hotter areas. This process is further complicated by the rotation of the Earth, which causes the air flowing from equator to poles to move in easterly and westerly directions. We call this air flow "wind." In most regions the wind tends to blow in mainly one direction—the prevailing direction—and this is called the "prevailing wind." The direction of the prevailing wind may change at different times of year. In addition, the pressure of air in the atmosphere varies. Where pressure is low (a depression), strong winds are typically found. Where pressure is high (an anticyclone), winds are generally light. In this project you will construct an air vane and measure wind direction for one week, and use an anemometer to track wind speed over the same period.

TIME NEEDED:

45 minutes to make the wind vane
5 minutes each day for two weeks to observe

MATERIALS:

empty plastic food container (*e.g.*, 8 oz. yogurt container) approximately 10 cm high
piece of thin cardboard
scissors
ruler
pencil
pencil with eraser on the end
felt-tip marker
plastic drinking straw
glue
thumbtack
modeling clay
directional compass
hand-held anemometer*
2 photocopies of wind chart
graph paper

* Note: anemometers, if unavailable at the school, can be borrowed or rented from a laboratory equipment supplier.

Safety Precautions

Please click on above link to view our safety guidelines.

PROCEDURE:

Making the wind vane

1. Turn the plastic container upside down. Make a hole in the center of the base with the scissors. Push the pencil (with the eraser) into the hole—it should be a tight fit. The eraser end should be sticking out.
2. Draw four identical triangles on the cardboard, each with a base of 1.25 cm and height of 1.25 cm. Cut out the triangles using the scissors.
3. Glue the triangles, pointing outwards and at 90° angles to each other, onto the base of the container, as shown in figure 1. Label the triangles "N", "E", "S", and "W" in the sequence shown on the directional compass—these are the compass points of the wind vane that will show which way the wind is blowing.

4. Draw two more triangles on the cardboard: one with a base and height of 6.25 cm, the other with a base and height of 3.75 cm. Cut out the triangles.
5. Take the drinking straw. Cut 1 cm slits into both sides of each end of it.

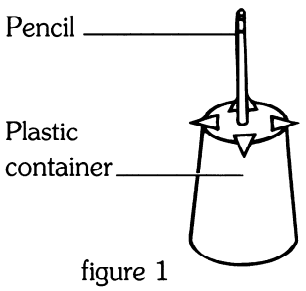


figure 1

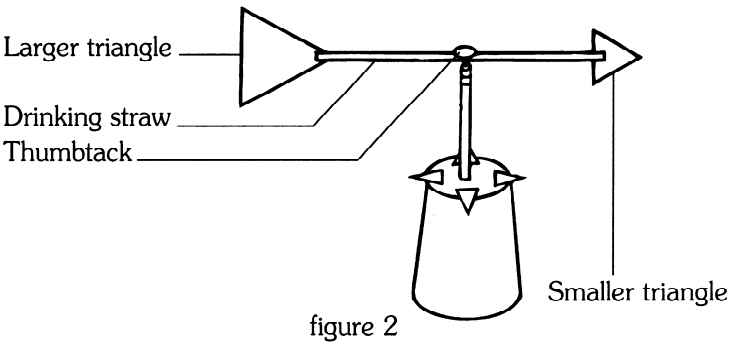


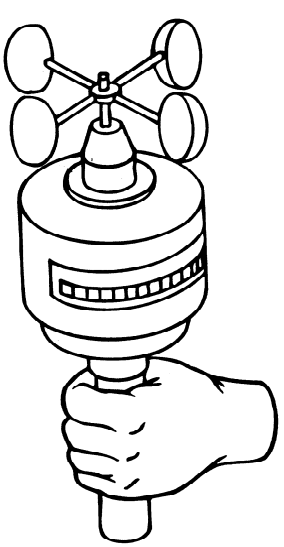
figure 2

6. Put a little glue on the apex of the larger triangle. Push its apex into the slit at one end of the drinking straw.
7. Put a little glue on the center of the base of the smaller triangle. Push the base into the slit at the other end of the drinking straw.
8. Squeeze the drinking straw at both ends to ensure that both triangles are glued securely in place.
9. Push the thumbtack through the center of the drinking straw. Then push the thumbtack (and straw) into the eraser at the end of the pencil. The wind vane is now complete—make sure it can spin freely. (See figure 2.)

Using the wind vane and anemometer

10. Measure wind direction and speed at the same time and at the same place every day. Choose a location that is in an open space above ground level, such as on a hill or on a roof.
11. Make a ring of modeling clay to hold the wind vane in position. Put the directional compass down flat. Position the wind vane in the modeling clay ring so that the triangle marked "N" points in the same direction as North shown by the directional compass.
12. Each day note the wind direction on the Wind Chart and fill in a box in the "arm" showing the wind direction for that day. Fill in the box either by writing in the date (*e.g.*, TUESDAY JUNE 15) or by having a different color for each day of the week.
13. Measure wind speed by holding up the anemometer. Read the value for wind speed from the scale. Note whether it is meters per second or kilometers per hour. Record the value in the Data Table.

figure 3 Anemometer

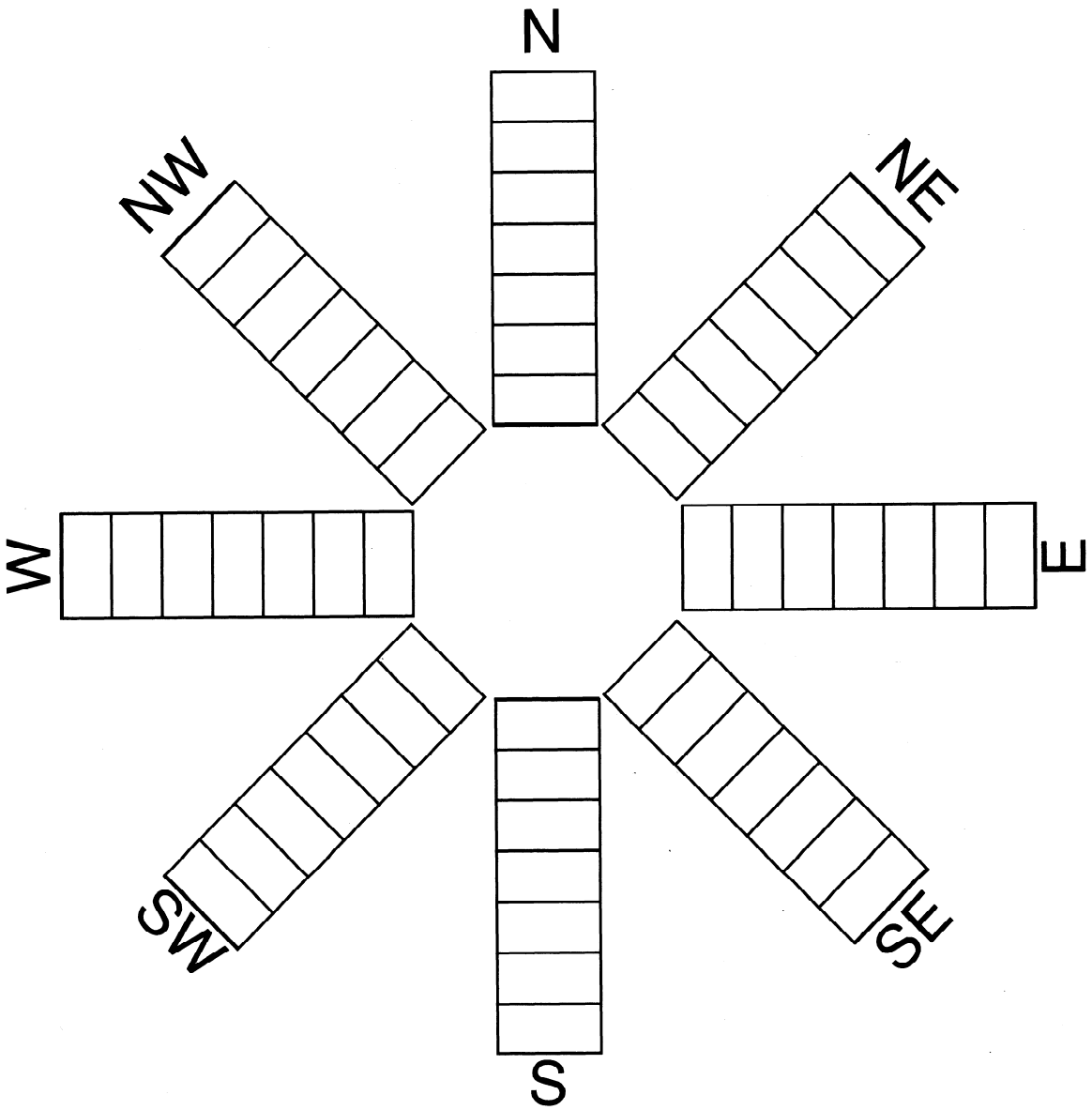


14. Make a brief note of the weather conditions for each day you were recording. Record your observations in the Data Table with your wind speed readings.

WIND CHART

Date:

Location:



DATA TABLE

Day	Wind speed	Weather conditions
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

ANALYSIS:

1. What was the prevailing wind direction in your area?
2. Was there a great variation in wind direction over the two-week period?
3. On a piece of graph paper, plot the changes in wind speed over the two-week period. Your x-axis (across the bottom of the graph) will show the days, from 1 to 14 for the two-week period. Your y-axis will show the wind speed, in kilometers per hour. If your wind speed was recorded as meters per second, multiply each value by 3.6 to convert it to kilometers per hour.
4. Look at the chart showing wind speeds classified on the Beaufort scale, below. Next to each point on the graph, write the equivalent number from the Beaufort scale. What was the highest point reached on the scale?

Beaufort Scale

Number	*Description*	*Wind speed (km/h)*	*Characteristics*
0	Calm	<1	Smoke rises vertically
1	Light air	1–5	Direction shown by smoke
2	Light breeze	6–12	Direction shown by wind vane
3	Gentle breeze	13–20	Wind extends a light flag
4	Moderate breeze	21–29	Raises dust and loose paper
5	Fresh breeze	30–39	Small trees in leaf start to sway
6	Strong breeze	40–50	Umbrellas used with difficulty
7	Moderate gale	51–61	Inconvenient to walk against wind
8	Fresh gale	62–74	Twigs broken off trees
9	Strong gale	75–87	Shingles and slates removed
10	Whole gale	88–102	Trees uprooted; considerable damage
11	Storm	103–120	Widespread damage
12–17	Hurricane	>120	Extremely violent

5. Was there any connection between wind speed and direction, and the general weather conditions during the two-week period?

OUR FINDINGS:

Click on above link to see what we found.

Our Findings

II. WEATHER PROJECTS

2.003 Wind Station

1. Results will vary.
2. Results will vary.
3. Results will vary.
4. Results will vary.
5. Results will vary. Students should look for incidences of, for example, high winds and no rain, or no wind and mist or fog.

SPECIAL SAFETY NOTE TO EXPERIMENTERS

Each experiment includes a short list of special safety precautions that are relevant to that particular project. However, these do not include all of the basic safety precautions that are necessary whenever you are working on a scientific experiment. For this reason, it is absolutely necessary that you read, copy, and remain mindful of the General Safety Precautions that follow this note.

Experimental science can be dangerous, and good laboratory procedure always includes carefully following basic safety rules. Things can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. There will be no time after the fact to protect yourself. Always prepare for unexpected dangers by following basic safety guidelines the *entire* time you are performing the experiment, whether or not something seems dangerous to you at a given moment.

We have been quite sparing in prescribing safety precautions for the individual experiments. We made this choice for one reason: We want you to take very seriously every safety precaution that is printed in this book. If you see it written here, you can be sure that it is here because it is absolutely critical to your safety.

One further note—The book assumes that you will read the safety precautions that follow, as well as those at the head of each experiment you are preparing to perform, and that you will *remember* them. Except in rare instances, these precautions will not be repeated in the procedure itself. It is up to you to use your good judgment and pay attention when performing potentially dangerous parts of the procedure. Just because the book does not say BE CAREFUL WITH HOT LIQUIDS or DON'T CUT YOURSELF WITH THE KNIFE does not mean that you should be careless when simmering water or stripping an electrical wire. It does mean that when you see a special note to be careful, it is extremely important that you pay attention to it.

If you ever have a question about whether a procedure or material is dangerous, wait until you find out for sure that it is safe.

GENERAL SAFETY PRECAUTIONS

Accidents caused by carelessness, haste, insufficient knowledge, or taking unnecessary risks can be avoided by practicing safety procedures and being alert while conducting experiments. Be sure to check the experiments in this book for additional safety regulations and adult supervision requirements. If you will be working in a lab, do not work alone.

PREPARE:
—Clear all surfaces before beginning experiments
—Read the instructions before you start
—Know the hazards of the experiments and anticipate dangers

PROTECT YOURSELF:
—Follow the directions step-by-step; do only one experiment at a time
—Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eye wash, and first-aid kit
—Make sure there is adequate ventilation
—Do not horseplay
—Wear an apron and goggles
—Do not wear contact lenses, open shoes, loose clothing, or loose hair
—Keep floor and work space neat, clean, and dry
—Clean up spills immediately
—Never eat, drink, or smoke in laboratory or work space
—Do not eat or drink any substances tested unless expressly permitted to do so by a knowledgeable adult

USE EQUIPMENT WITH CARE:
—Set up apparatus far from the edge of the desk
—Use knives and other sharp or pointed instruments with caution
—Pull plugs, not cords, when removing electrical plugs
—Don't use your mouth to pipette; use a suction bulb
—Clean glassware before and after use
—Check glassware for scratches, cracks, and sharp edges
—Clean up broken glassware immediately
—Do not use reflected sunlight to illuminate your microscope
—Do not touch metal conductors
—Use only low voltage and current materials such as lantern batteries
—Be careful when using stepstools, chairs, and ladders

USING CHEMICALS:
—Never taste or inhale chemicals
—Label all bottles and apparatus containing chemicals
—Read labels carefully
—Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves)
—Do not touch chemical solutions
—Wash hands before and after using solutions
—Wipe up spills thoroughly

HEATING SUBSTANCES:
—Use goggles, apron, and gloves when boiling water
—Keep your face away from test tubes and beakers
—Never leave apparatus unattended
—Use safety tongs and heat-resistant mittens
—Turn off hot plates, bunsen burners, and gas when you are done
—Keep flammable substances away from heat
—Have fire extinguisher on hand

GOING ON FIELD TRIPS:
—Do not go on a field trip by yourself
—Tell a responsible adult where you are going and maintain that route
—Know the area and its potential hazards, such as poison plants, deep water, and rapids
—Dress for terrain and weather conditions (prepare for exposure to sun as well as to cold)
—Bring along a first-aid kit
—Do not drink water or eat plants found in the wild
—Use the buddy system; do not do outdoor experiments alone

FINISHING UP:
—Thoroughly clean your work area and glassware
—Be careful not to return chemicals or contaminated reagents to the wrong containers
—Don't dispose of materials in the sink unless instructed to do so
—Wash your hands
—Clean up all residue and put in proper containers for disposal
—Dispose of all chemicals according to all local, state, and federal laws

BE SAFETY CONSCIOUS AT ALL TIMES